REMARKS/ARGUMENTS

This case has been carefully reviewed and analyzed in view of the Official Action dated 25 April 2006. Responsive to the rejections made in the Official Action, Independent Claim 1 has been thoroughly amended to clearly emphasize the distinguishing features of the present invention over the cited prior art. Claim 12 has been cancelled without prejudice to incorporate the subject matter thereof into Independent Claim 1; and Claims 2 – 11 and 13 have been amended to improve the Claim language thereof.

In the Official Action, Claims 6, 8, 10 and 13 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Rusta-Sellehy et al., U.S. Patent Application Publication 2003/0091876A1 in view of Nagasawa et al., U.S. patent 4,988,283; Claim 7 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Rusta-Sellehy et al. and Nagasawa et al., and further in view of Andou et al., U.S. Patent 6,638,653; Claim 9 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Rusta-Sellehy et al. and Nagasawa et al., and further in view of Kobayashi et al., U.S. Patent Application Publication 2002/0146606A1; and Claims 11 and 12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Rusta-Sellehy et al. and Nagasawa et al., and further in view of Knights et al., U.S. Patent 6,500,572.

Prior to discussion of the distinguishing features of the subject invention over the cited prior art references, taken solely or in combination thereof, it is

believed that the brief review of each of the cited prior art references will facilitate prosecution of the present Patent Application.

Rusta-Sellehy et al., the main reference cited by the Examiner is directed to a chemical hydride hydrogen generation system and fuel cell stack incorporating a common heat transfer circuit. The system includes a chemical hydride storage tank 5, a reactor 20, a fuel cell stack 3 and some peripherals, namely a coolant storage tank 4, a heat exchanger 14 and a gas-liquid separator 16. When hydrogen is demanded by the fuel cell stack 3, the hydride is supplied to the reactor 20 through a line 22 by means of a pump 26. The hydride reacts within the reactor 20, thus producing hydrogen. The generated hydrogen flows out through a hydrogen outlet of the reactor 20 and is supplied to an anode inlet of the fuel cell stack 3 via a hydrogen line 11. In the fuel cell stack 3, an oxidant, typically air is introduced through an air inlet 7 into the cathode of the fuel cell stack 3.

The fuel cell stack 3 generates electricity while consuming the hydrogen supplied from the reactor 20. In order to provide the hydrogen generation system with a load measuring capability, a pressure sensor 18 is provided at the hydrogen outlet of the reactor 20. The pressure sensor 18 is in connection with a switch 24 in hydride supply line 22 and controls the operation of same, and the switch 24 controls the pump 26 pumping the solution from the tank 5 to the reactor 20. When the fuel cell stack 3 operates in a condition that the hydrogen generation rate in the reactor 20 is more than the hydrogen consumption rate in the fuel cell stack

3, the pressure of hydrogen in the reactor 20 increases until it reaches a certain value when the pressure sensor 18 activates the switch 24 to shut down the pump.

It is respectfully submitted, that Rusta-Sellehy et al. Patent, although providing some type of air flow control in the system, in contrast to the present invention, fails however to base such a control on the reading of the output voltage or output current of the fuel cell stack. In Rusta-Sellehy et al., as clearly presented in paragraph [0046], the control of the system is performed solely on the reading of pressure sensor 18 which is provided at the hydrogen outlet of the reactor 20.

Opposingly in the present invention, in addition to controlling the hydrogen flow rate through the hydrogen supply conduit, the air flow rate is controlled in accordance with the detected output voltage of the fuel cell stack. This feature is completely missing in Rusta-Sellehy et al.

Nagasawa et al., another prior art reference, cited by the Examiner, is directed to a fuel cell power generating apparatus and method for controlling same. Nagasawa et al. teaches a fuel cell device 7 in which chemical energy generated through an electrochemical reaction between a fuel gas 51 and fuel air 45 is converted into electrical energy to thus generate DC electric power. The control of the flow rate of the fuel air 45 is performed by a flow rate controller 8 which comprises a blower or a pump. The system includes a fuel cell voltage detecting unit 13 which detects the voltage outputted from the fuel cell device 7 and outputs a cell voltage signal 706 to the operational control unit 6. The amounts of a starting material 41 to be reformed, a reformed fuel 42 and an air 43

to be supplied to the fuel cell device 7 are controlled based on the output current (or voltage) of the fuel cell device.

It is respectfully submitted, that although Nagasawa et al. Patent does teach the detection of the output current and voltage of the fuel cell device and control of the air supply to the fuel cell in accordance with the detected output parameters, the reference however, in contradistinction with the present invention fails to teach that when the detected output voltage is lower than a preset lower voltage level, the air supplying flow rate in the air supply conduit is increased to a maximum air flow rate for a predetermined period of time to remove unwanted liquid accumulated in the fuel cell tank, or suggest that simultaneously with increasing of the air flow rate, opening the hydrogen exhaust valve so that the liquid accumulated in the fuel cell stack is expelled therethrough.

The present invention teaches that the air flow rate is increased to a maximum value and the hydrogen exhaust valve is opened during respective first and second periods of time to expel liquid from the fuel cell stack, when the output voltage thereof falls below a predetermined value indicative of unwanted accumulation of the liquid in the fuel cell stack. These features are not taught by Nagasawa et al. Patent.

Andou et al., another reference cited by the Examiner is directed to a fuel cell system, which includes a fuel cell 1, an operator unit 2, a reactor unit 3, and an air compressor 4. The fuel gas is exhausted from the reactor unit 3 and is supplied to the anode side of the fuel cell 1. The air compressor 4 supplies the fresh air to

the fuel cell 1. The off-gas which is an exhaust gas is exhausted from both sides (an anode side and cathode side) of the fuel cell 1. A flow rate control valve 8, is provided between the air compressor 4 and the fuel cell 1 of the air supply line 6. The flow rate control valve 8 controls the flow rate supplied to the fuel cell 1. Fuel gas flow control valve 9 controls the flow rate of the fuel gas supplied to the fuel cell 1. The power generation of the fuel cell 1 is controlled by controlling the flow rate of the fuel gas supplied to the fuel cell using the flow control valve. That is, when the opening of the fuel gas flow control valve 9 is set as wide as possible and a large amount of the fuel gas is supplied to the fuel cell 1, the power generation of the fuel cell 1 will be increased. On the contrary, when the opening of the fuel gas flow control valve 9 is set as narrow as possible and a small amount of the fuel gas is supplied to the fuel cell 1, the power generation of the fuel cell 1 will be decreased.

A control unit controls the system to obtain the target value of the output current of the fuel cell 1. Depending on the target value of the output current of the fuel cell 1, the output current of the fuel cell is determined. After determining the output current, the opening of the fuel gas flow control valve is controlled corresponding to the output current by the control unit. For example, if the required power output of the fuel cell is decreased, the control unit decreases the flow rate of the air supplied to the fuel cell 1 by decreasing the flow rate of the air after making the flow rate increase. Therefore, when the output current of the fuel cell 1 decreases, the control unit sets an opening of the flow rate control valve to a

wide open state so that the flow rate of the air supplied to the fuel cell 1 may increase.

It is respectfully submitted, that in contrast to the present invention, and similar to Rusta-Sellehy et al. and Nagasawa et al., the Andou et al., fails to teach the increase of the air flow in the air supply conduit to a maximum air flow rate (for a first predetermined period of time) and simultaneous opening of the hydrogen exhaust valve to remove therethrough unwanted liquid accumulated in the fuel cell stack following by shutting the hydrogen exhaust valve upon a second predetermined period of time is over in response to the lowering of the output voltage of the fuel cell stack.

Kobayashi et al. another reference cited by the Examiner, is merely a warm up apparatus for a fuel cell. The fuel cell system comprises a fuel cell 1, an air supply section 2, a hydrogen supply section 3 and a controller 4. The fuel cell system is an electricity generating system which further includes a warm up apparatus for the fuel cell 1 which substantially consists of the air supply section 2 and the controller 4. During the normal operation of the fuel cell 1, the intercooler 23 cools supply air from the compressor 22 by heat exchange between cooling water and supply air.. The temperature of the supply air that is fed from the compressor 22 during the normal operation of the fuel cell 1 is usually about 120°C. However, the fuel cell 1 is driven in the temperature range of about 80° to 90°C. For this reason, supply air is cooled down to a temperature of about 60° to 75°C and then in introduced into the fuel cell 1.

It is respectfully submitted, that Kobayashi et al. is believed to be cited merely for the purpose of showing the temperature control of the system containing the fuel cell and, in contrast to the present invention, fails to teach controlling the air pumping device in accordance with the detected output voltage of the fuel cell to increase the air flow in the air supply conduit to a maximum air flow rate and simultaneously opening the hydrogen exhaust valve to remove therethrough unwanted liquid accumulated in the fuel cell, maintaining the maximum air flow rate for a predetermined period of time, and closing the hydrogen exhaust valve upon the liquid from the fuel cell is removed.

Knights et al., a further reference cited by the Examiner, is directed to a method for operating fuel cells on impure fuels. The system described in the reference comprises a solid polymer fuel cell stack 1, a fuel processor 2, a supply of fuel 3, for example methanol, and a supply of oxidant 4, for example, compressed air. The fuel and oxidant streams are supplied to the fuel cell stack 1 through the fuel and oxidant outlets 7 and 8, respectively.

The system also comprises an oxygen supply and a flow controller 10 for introducing a variable amount of oxygen into the fuel stream upstream of the fuel cell stack at 11. The system further comprises a sensor cell 12 whose voltage output work performance is particularly sensitive to carbon monoxide. Sensor cell 12 is situated within the fuel cell stack 1. Thus, sensor cell 12 effectively monitors the carbon monoxide level in the fuel stream directed to stack 1. The voltage of the sensor cell 12 is used as a signal to adjust flow controller 10.

Flow controller 10 controls the concentration of air introduced into the fuel stream. Flow controller 10 comprises a flow control valve having an opening that is variable in accordance with the signal from the sensor cell 12. Flow controller 10 is used to adjust the amount of air bleed in accordance with the concentration of carbon monoxide entering the fuel cell stack 1.

As presented in the Knights et al. Patent (column 8, lines 26 and further), with the introduction of carbon monoxide in the fuel stream, the voltage of both fuel cell and sensor cell drops substantially. The performance of the cells is then restored by introducing 4% air (by volume) into the fuel stream to oxidize carbon monoxide in the cells. The flow controller is then set so as to introduce a baseline level of 0.8% air into the fuel stream that would increase to a 4% air bleed level in the sensor cell voltage if the sensor cell voltage fell more than 100 mv.

It is respectfully submitted, that although Knights et al. controls the air flow in the system depending on the detected output voltage, in that system in contrast to the present invention, the decrease of the output voltage is indicative of increased levels of carbon monoxide.

Opposingly in the present invention, the decrease of the output voltage is indicative of accumulation of the liquid in the fuel cell stack.

Further, Knights et al. fails to supply the hydrogen to the fuel cell stack, or to maximize the air flow rate in the system and simultaneously open the hydrogen exhaust valve to remove therethrough unwanted liquid accumulated in the fuel cell stack. Knights et al. neither is concerned with expelling the liquid accumulated

from the fuel cell stack, as it is the case in the present invention, nor in his system the decrease of the output voltage is indicative of accumulation of the unwanted liquid in the fuel cell, as it is in the present invention.

The Examiner suggested the combination of Rusta-Sellehy et al. and Nagasawa et al. to result in the invention covered by the Independent Claim 6. It is respectfully submitted that Claim 6, as amended, cites (inter alia):

"... selectively driving the air pumping device mounted to the air supply conduit ... for controlling air flow rates through the air supply conduit in accordance with the detected output voltage of said fuel cell stack, wherein, when the detected output voltage is lower than a preset lower voltage level indicative of a presence of an unwanted liquid accumulated in the fuel cell stack,

controlling the air pumping device to increase the air flow in the air supply conduit to a maximum air flow rate ...to thereby remove unwanted liquid accumulated in said fuel cell stack,

maintaining said maximum air flow rate during a first predetermined period of time, and

controlling air pumping device to resume to a normal flow rate upon said first predetermined period of time is over ..."

These features of the present invention have not been disclosed, suggested, or rendered obvious by Nagasawa et al. nor Rusta-Sellehy et al., taken solely or in combination thereof.

It is respectfully submitted that absent the Applicant's disclosure, there is no motivation for combining the control of the air flow in Nagasawa et al. (which itself fails to teach increasing the air flow to a maximum air flow rate to thereby remove unwanted liquid accumulated in the fuel cell stack) with Rusta-Sellehy et al. (which fails to teach the detection of the output voltage or current of the fuel cell stack at all and control of the system based on the output voltage or current). Absent from the Applicant's disclosure, there is absolutely no motivation for combining these two references; and it can only be thought an improper use of "hindsight" using Applicant's disclosure as a "blueprint" for the combination, that the Examiner suggests such a combination of references, Nagasawa et al. and Rusta-Sellehy et al.

Arguendo, even if the teachings of Nagasawa et al. and Rusta-Sellehy et al. are combined, it is believed that the combination of elements of the invention of the subject Patent Application, as now claimed in Independent Claim 6, still provides patentable distinction over the structure resulting from the Examiner's suggested combination. As the Independent Claim 6 clearly directs itself to the concept and structure which are not taught by the cited prior art Rusta-Sellehy et al. and Nagasawa et al., it is believed to be patentably distinct over the cited prior art, Nagasawa et al. and Rusta-Sellehy et al., taken singly or in combination. Accordingly, Independent Claim 6 is believed to be allowable; and the same is respectfully requested.

It is also respectfully submitted that none of the references cited by the Examiner, Rusta-Sellehy et al., Nagasawa et al. Andou et al., Kobayashi et al. and Knights et al. taken singly or in any combination thereof, discloses, suggests or renders obvious the method for controlling a fuel cell system in which, responsive to the decrease of the output voltage (which is indicative of the presence of liquid in the fuel cell stack), the air pumping device is controlled to increase the air flow in the air supply conduit to a maximum air flow rate to remove unwanted liquid accumulated in the fuel cell stack, maintaining the maximum air flow rate during a first predetermined period of time and resuming the air flow rate to a normal rate thereafter.

Independent Claim 6 recites (among others) these distinguishing features of the present invention over the cited prior art. As the Independent Claim 6 clearly directs itself to the concept and structure as presented above, it is believed to be patentably distinct over the cited prior art, singly or in combination. Accordingly, Independent Claim 6 is believed to be allowable; and the same is respectfully urged.

Claims 7 – 11 and 13, directly or indirectly dependent upon Claim 6, are believed each to add further limitations that are patentably distinct in addition to being dependent upon what is now believed to be patentable base claim, and therefore, allowable for at least the same reasons.

New Claims 14 and 15, dependent upon Claim 6, have been added to the case. Claim 14 calls for opening the hydrogen exhaust valve when controlling the

air pumping device to increase the air flow to a maximum air flow rate; and Claim 15 is limited to maintaining the hydrogen exhaust valve open during a second predetermined period of time, and closing the same when it is over.

These features are not taught by any of the cited prior art references, as has been presented in the previous paragraphs. Accordingly, the allowance of Claims 14 and 15 is respectively requested.

For all of the foregoing reasons, it is now believed that the subject Patent Application has been placed in condition for allowance, and such action is respectfully requested.

Respectfully submitted,
FOR ROSENBERG, KLEIN & LEE

Morton J. Rosenberg

Morton J. Rosenberg
Registration #26,049
Dated: 7/19/06

Suite 101
3458 Ellicott Center Drive
Ellicott City, MD 21043
(410) 465-6678
Customer No. 04586